

# A Comparative Study Between A Computer-Aided Education (ISIS) and Habitual Education Techniques For Hypertensive Patients

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## Abstract

ISIS is a patient education computer program about hypertension. It aims to be complementary to the habitual educational techniques by bringing into patient education the facility of multimedia features. Its efficiency in improving the knowledge about hypertension was tested among 158 hypertensive patients. Their prior knowledge was evaluated using a questionnaire. They were then randomly separated in a control group (CG) which had the regular education program and ISIS group or (IG) which, in addition, had an interactive session using ISIS. Two months after discharge, all the patients were asked the same questions over the telephone. A total of 138 observations (69 CG, 69 IG) were reported in the final analysis. The initial scores were significantly improved for both groups. The improvement is more evident in the IG, particularly among patients whose initial score was low and patients whose hypertension was discovered for more than 6 months. ISIS is actually used by hospitalized patients and by nurse students.

## INTRODUCTION

Patient education is an important step toward the patient understanding of preventive measures. Building a patient educational program is a difficult task which involves decisions about knowledge representa-

tion and communication strategies. The use of computers as a medium for patient education is even a more difficult choice, as evaluation studies are uncommon in the literature [1]. These difficulties were emphasized by physicians at the Departement of Hypertension (Professors Corvol P., Ménard J.) at Broussais Hospital in Paris-France, as they decided to develop a computer-aided education program for hypertensive patients about hypertension and cardiovascular risks. The computer-aided education as a neutral medium, will help address communication biases [2] such as patient passiveness and misinformation about the disease, which in turn will improve the complex patient-educator relationship. This latter is particularly influenced by the way the patient lives with the disease, the suddenness of its discovery and the willingness to comply with the constraining therapy and prevention. The fact of being sick and in need of health care, "infantilizes" the patient in the presence of a "healthy" and "knowledgeable" health care educator. The "infantilization", is transformed into passiveness which masks the patient real knowledge about the disease, and retains unexploited potential information. By providing more autonomy, the computer-aided education will comfort the patient in the role of actively controlling the access to the knowledge. The easiness and the pleasure in using it and the recollection of the contents after, will determine the success of this method.

A computer program called ISIS<sup>1 2</sup> was developed in the period of 1990-1992 and a comparative study in

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<sup>1</sup>ISIS: Initiation Sanitaire Informatisée et Scénarisée

<sup>2</sup>ISIS is also a personage from the ancient Egypt

1993, showed its high performance particularly among categories of hypertensive patients. It is actually used patients with other methods in the Department of Hypertension, where emphasis is put on the patient education given the context of hypertension.

## Background

Hypertension represents a major risk factor for coronary, cerebral and renal vascular diseases. It has a high prevalence among populations and plays a major role in the aggravation of the overall risk of premature cardio-vascular diseases [3, 4]. The severity of the disease imposes a rapid and long term drug treatment. Statistical findings [5, 3] show the benefits of associating a serie of a non-pharmacological therapies such as diet, quitting smoking, preventing overweight and sedentariness, controlling reaction to stress and improving the quality of life. In summary, the success of hypertension therapy requires important behavioral changes. *"Still the inherent agreement between the physician and the patient are at the basis of the success in the treatment"*[3]. Unfortunately, statistical findings, reveal a failure among patients, to comply with the long term therapy [6] and make the the health education of hypertensive patients even more necessary.

## Specifications

The following specifications identified the scope and the context of using ISIS:

- the computer-aided education will be used without the educator full-time assistance,
- the patients will pilot their own progress in finding out about hypertension and associated risks,
- the educational contents will use accurate, up-to-date knowledge, as identified by a team of experts,
- the educational contents will be represented and communicated, in an easy-to-access way, considering age variation, diversity of cultural backgrounds and unfamiliarity with computers,
- the educational contents will avoid direct instruction and will use "agreeable" and appropriate ways in informing about the disease and prevention,
- the computer-aided education will provide ways of evaluating itself, and evaluating the patient educational progress.

# MATERIAL AND METHODS

## Development Phase

### Hardware, Software

ISIS is developped on a color MacIntosh, and uses the following software to create graphics (MacPaint, PixelPaint), to create animations (MacroMind Director) and to digitize sound (MacRecorder). To the best of our knowledge, these were the most adapted tools to develop an aplication that meets the specifications. ISIS runs on MacIntosh II and higher and requires 8 megabytes of RAM, a coprocessor and a color monitor of 13 inches. It takes 32 megabytes of disk space and is organized into 30 MacroMind Director files or "movies". Macros and scripts use a high level language ("Lingo") to navigate between files and to keep track of the patient performance. Creating animations is trivial and sophisticated scenarios are not difficult to develop using the "Lingo" programming language.

### Design consideration

ISIS combines graphical symbols and icons with texts into a real communication language. The icons design and arrangement on the screen had to address design issues. We will use the outline in [7] to describe them:

- *Lexical issues or how icons are produced ?* The icon size, shading, corner angle, line thickkness, color brightness, are about the same and few style variations, such as differences in shapes and colors, are used in different modules. Textual labels are associated with the icons.
- *Syntactic issues or how do the signs appear in space and time ?* The icons are used when asking questions, for immediate answer feed-back, for explanations, for help and for navigation. Each category appears in the same position in the screen and respectively in the same context.
- *Semantic issues: to what do the signs refer ?* Depending on the context, the icons point to concrete objects such as body organs, food, medical equipment, therapeutical objects; or to abstract objects, such as age, time, stress, therapeutical function, physiological function, social life, life style, daily events and familiar objects, etc.
- *Pragmatic issues: How the signs are used ?* Icons legibility is favored under typical viewing distances and ambient lighting. They have to be easy to identify both individually and within groups.

The advantage of using icons is that they can be understood immediately, faster than reading textual information. They do not depend on a language, and do not require a prior study. They have to be precise though, avoiding ambiguities and unnecessary details. They also have to be frank, carrying warm expressions and leaving the viewers with pleasant sensation. Familiarity and simplicity generally add weight to their meaning, humor and wittiness favor their acceptance among viewers [8]. The use of a grid, facilitates consistency in the screen design and the objects arrangement. There are minimal variations in the answer modes and the general mode of using ISIS is reduced to learn how to use the mouse click, which is explained by the nurse, Mrs Jean, at the beginning of the interaction.

ISIS tries to capture the user attention and to take her/him away from the anxiousness and the stress of the context of the disease. It proposes a diverting educational moment.

### **The Computer Program Contents**

The educational program alternates relaxing interludes with educational messages. The patients discover the educational program as they progress through an imaginary trip in the ancient Egyptian world. At any time, they may look how far they went in the trip by consulting a map, or look how far they went in the educational part by consulting a list of visited modules. Leaving the program can be done at any time, and a patient identifier number allows to continue where left off.

**The interludes** help relax and refresh the attention between two educational interactions. A guide: "ISIS" will accompany the patient along the trip. At each step three referees present the rules to clear obstacles and if successful, the patient will be rewarded by a pleasant view along with a selected music.

**The educational part** consists of series of questions (three to five) presented to the patient and require a response. Animated messages of "Bravo" or "Inexact" follow and a performance score summary is presented after each serie of questions. The patient may then consult an explanation, usually a graphical animation that illustrates the experts messages in the specific context of the questions. The patient may review the questions, move to the following section or

just leave the program. Six modules covering educational topics in hypertension and cardio-vascular diseases, constitute the educational part. They are:

**Arterial pressure** General notions about arterial pressure are presented in this module. Blood pressure physiology, systolic and diastolic pressures measures and variations with day time, age, environment, are described in a first part. In a second part, the arterial pressure measurement and the underlying physiology, are described to the patient.

**Epidemiology** In this module, notions such as: hypertension severity, prevalence, etiology, heredity, dietary prevention and the organic lesions hypertension causes, are explained to the patient.

**Heart** This module includes explanations about the heart physiology, gross anatomy, systemic and pulmonary circulations.

**Atherosclerosis** A first part covers the physiology of the arterial sclerosis and its evolution with age. A second part describes the atheroma pathophysiology and complications.

**Risk factors** This module describes the factors that could be modified, including nutritional and life style habits, to prevent from the risk of premature cardiovascular diseases. Realistic scanned images illustrate varieties of aliments and dishes, presented as function of their amounts in fat.

**Treatment** This module describes the drug mechanism of action using analogies with daily life scenes. The drug classes and their specific mode of action are described in a second part.

The patient will interact with a number of educational modules and if successful, will obtain enough bonus points to access to a secret room in a symbolic edifice: the "Pharmacy" which is the final step of the imaginary trip. The patient will receive from ISIS some symbolic objects as a reward to the quest of knowledge, and which will accompany her/him in another imaginary trip. During the development phase physicians experts, psychologists, nurses, dieticians, at the Department of Hypertension, and medical informatics professionals in Broussais Hospital provided valuable feedback. They helped reach a consensus about the contents, their representation and the communication methods developed in ISIS program.

## Evaluation Phase

### Methods

A pre-study phase helped refine ISIS program and prepare the final evaluation. It was organized into two phases: first, the ISIS program was shown to a large number of health professionals working in the Department of Hypertension. The general reaction was favorable and additional refinements were incorporated into the program. A second phase focused on the reaction of a small group of 30 patients who had an exploratory interaction with ISIS program. A preliminary questionnaire was proposed and helped prepare the final evaluation questionnaire.

The objective of the final evaluation was to analyze the effect of using ISIS program as a complement to the already existing patient education methods, on the patient knowledge about hypertension. A randomized study was undertaken during the period between March 1, 1993 and September 30, 1993 and included 158 hypertensive patients among hospitalized patients for initial check-up or therapeutic adjustment. They were randomly separated into two groups, a control group (CG), (79 patients) and an intervention group or ISIS group (IG), (79 patients). An initial evaluation of the patients knowledge about hypertension was made after admission to the Department. A questionnaire of 28 items prepared in collaboration with experts in hypertension and cardio-vascular diseases, was proposed to the 158 patients. The CG then followed the regular educational activities which consist of educational sessions, dialogs with physicians, nurses, dieticians and access to health information through brochures, posters and videotapes. The IG in addition to the regular educational activities had during 30 to 60 minutes, an interactive educational session using the ISIS program. Two months after discharge, the same investigator: Mrs Jean, asked the 158 patients over the telephone the same series of 28 questions. Some of the patients missed a follow-up questionnaire and were dropped from the final analysis. The results of only 138 patients are reported in the final analysis. They are distributed into, 69 in the IG and 69 in the CG and their socio-demographic and clinical characteristics are described in table 1.

## RESULTS

From the beginning we explored the links between the initial health score and sex, age or general instruction.

Table 1: Study Population: General Characteristics.

|                             |                      |            |
|-----------------------------|----------------------|------------|
| population                  | 138                  |            |
| sex                         | 65 men               | 73 women   |
| age                         | 50.4                 | $\pm 12.4$ |
| duration of hypertension    | less than 6 months   | 51         |
|                             | 6 months - 2 years   | 26         |
|                             | more than 2 years    | 61         |
| general instructional level | high school          | 51         |
|                             | finished high-school | 35         |
|                             | college - university | 51         |
| initial test                | $14.3 \pm 4.2$       |            |

Table 2: Comparative evolution of health knowledge.

| study group                          | ISIS          | Control       | P     |
|--------------------------------------|---------------|---------------|-------|
| total population (138)               | $3.8 \pm 3.6$ | $2.4 \pm 3.2$ | 0.02  |
| Initial score $\leq 16$ (89)         | $4.8 \pm 3.6$ | $2.9 \pm 3.0$ | 0.008 |
| age $\leq 65$ years (118)            | $4.2 \pm 3.4$ | $2.6 \pm 3.3$ | 0.01  |
| Women (73)                           | $4.6 \pm 3.7$ | $2.4 \pm 2.9$ | 0.006 |
| hypertension more than 6 months (87) | $3.8 \pm 3.5$ | $1.8 \pm 3.0$ | 0.006 |

**Prior health knowledge:** The mean score of prior health knowledge tested with the first questionnaire was  $14.3 \pm 4.2$  (extremes : 4 to 25), which corresponds to approximately 50% of correct answers. This score is positively correlated to the patient age (Pearson's  $r = 0.31$ ;  $p = 0.0002$ ), to the level of general instruction (Spearman's  $\rho = 0.36$ ;  $p = 0.0001$ ) and linked to the sex ( $p = 0.027$ ). The mean score of prior health knowledge is higher among men ( $15.1 \pm 4.6$ ;  $p = 0.027$ ) than among women ( $13.5 \pm 4.7$ ;  $p = 0.027$ ); the level of general instruction being also higher in the men subpopulation. The evolution of the health knowledge was estimated by calculating the difference of the global scores between the first and the second questionnaire.

**Evolution of health knowledge score in the global population:** The mean score is significantly improved in both groups ( $17.4 \pm 3.5$ ); the mean difference between the two tests is ( $3.1 \pm 3.5$ ) ( $p = 0.0001$ ; Student's t test for paired groups). The improvement is negatively correlated with the duration of hypertension ( $\rho = -0.19$ ;  $p = 0.04$ ) and with the initial health knowledge score ( $r = -0.32$ ;  $p < 0.0001$ ).

**Comparative results between the intervention and the control group:** Table 2 illustrates the differences between the two groups. The improvement

in hypertension knowledge is higher the IG than in the CG (using test t of Student for impaired groups). The differences are more evident among the patients whose *initial score was less than or equal to 16*, among the patients who are *less than 65 years* old and among the patients whose *hypertension* is discovered for *more than 6 months*.

## DISCUSSION

Despite the peculiarity of its context (hypertensive patients, hospitalized for a short stay in a specialized health center), the evaluation of ISIS program brings many arguments together in favor of this method as a complement to the habitual educational techniques. The patients who started with *average or low initial score* have more chances to significantly ameliorate their performance in the second test. The same argument explains the fact that women progressed more than men, between the two tests. The more important receptivity observed among the patients whose *age is less than 65 years* is not surprising. It is however interesting, to notice the difference between the habitual education techniques and the significant benefit brought by ISIS to the patients whose *hypertension is known for more than 6 months*. In other words, the hypertensive patients who discovered their disease for less than 6 months are more curious, more concerned and more receptive regardless of the educational method, than the long-term hypertensive patients, for whom the habitual education techniques efficiency "dries up" and the interactive education, with relaxing interludes, represents an interesting complementary method.

The role of the *nurse* in the organization of the evaluation protocol, and in encouraging the patients to use the computer, was certainly an essential factor in the relative success of ISIS program.

## FUTURE PERSPECTIVES

The evaluation study, still preliminary, encourages experimentation in other specialized health centers, and among a more representative hypertensive population. It needs to be demonstrated however, that the health knowledge improvement, and the pleasure and the activeness the patients manifested in using ISIS program, will promote a better compliance with the therapy, and a better quality of life. A long term evaluation of this method will elucidate these hypotheses.

ISIS is actually used by hypertensive patients hospitalized in the Department of Hypertension, and by nurse students, as part of their academic curriculum. The text messages in ISIS are in french language and prototype versions in english and in arabic are available. Finally, the development and implementation of ISIS, is an encouraging collaborative experience between medical informatics professionals, a team of psychiatrists and psychologists, physicians, nurses, dieticians, and communication professionals associated with the Departement of Hypertension at Broussais Hospital.

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